3. ASSUMPTIONS

The principal underlying assumptions for this fee adequacy analysis fall into three categories: (1) cost assumptions, (2) revenue assumptions, and (3) economic assumptions. Cost assumptions are based upon the 1999 TSLCC (CRWMS M&O 1999b). Revenue assumptions are based on projections of nuclear power generation. Interest and inflation rate forecasts are documented in the *Cost Escalation and Interest Rates for 1999* (CRWMS M&O 1999a) as part of the economic assumptions. Unless otherwise indicated, all dollar values in the remainder of this report are given in constant 1999 dollars in order to be consistent with the 1999 TSLCC report.

3.1 COST ASSUMPTIONS

The 1999 TSLCC (CRWMS M&O 1999b) estimate provides the cost basis for this assessment. The program costs obtained from the 1999 TSLCC analysis are based on EDA II, described in the LADS Report (CRWMS M&O 1999c), and expanded to cover all wastes planned for geologic disposal. However, this analysis differs from the 1999 TSLCC in categorizing future costs. The 1999 TSLCC includes 1999 costs as part of the program historical costs, and starts future costs in 2000. This analysis includes $0.4 Billion in 1999 costs as future costs to enable the use of the Office of Civilian Radioactive Waste Management FY 1998 audited financial statements (DOE 1999) as the starting point for the NWF balance.

The repository concept costed consists of a one-repository system without interim storage. This concept should be viewed as representative of the system that will ultimately be developed. Program costs will vary from the current estimate if future design approaches differ from the EDA II design in the LADS Report (CRWMS M&O 1999c). Costs may be higher or lower, and the uncertainties will be reduced over time as the Program moves through licensing and implementation. Future generations will make the ultimate decision on whether it is appropriate to continue to maintain the repository in an open, monitored condition or to close the repository. The 1999 TSLCC (CRWMS M&O 1999b) provided two cost estimates, Cases 1 and 2, for similar repository systems that differed only by the length of the monitoring phase. A fee adequacy assessment on these two cases provides insight into financial consequences for deferring the decision to close the repository.

The significant cost changes incorporated into the 1999 TSLCC (CRWMS M&O 1999b) based on EDA II include new waste package designs, titanium drip shields, back fill of the emplacement drifts, and lowering the areal mass loading, which requires excavation into the characterized lower block. The cost estimates for Case 1 and Case 2 have increased from the 1998 TSLCC (DOE 1998a) by $7.7 Billion and $13.0 Billion, respectively. These large increases have decreased the adequacy of the NWF for both cases; however, the adequacy for Case 2 has decreased less than the adequacy for Case 1. This result seems counter-intuitive, as the Case 2 cost increase is close to double the Case 1 cost increase. The reason for this result is that the large cost increases occur primarily at the end of the program when the drip shields and backfill are installed. For Case 1, these costs occur less than 20 years after the end of emplacement. For Case 2, these costs occurs almost 100 years after the end of emplacement, allowing the balance in the NWF to grow large enough to cover these large costs.

Estimated total system life cycle costs, in constant 1999 dollars, are organized into three major categories: (1) Monitored Geologic Repository, (2) Waste Acceptance, Storage and Transportation, and (3) Program Integration and Institutional. Program future costs are estimated to be $44.5 Billion for Case 1 (1999 through 2069), and $49.8 Billion for Case 2 (1999 through 2144). Tables 1 and 2 show the combined government-managed nuclear materials and civilian share allocations of estimated future total system cost for Cases 1 and 2, respectively. The determination of fee adequacy is based only on the civilian share of costs for Case 1 and Case 2.

Table 1. Case 1 Summary of Allocations of TSLCC Future Costs (Millions of 1999$)

Category	Future Cost Allocation – Case 1[a] (1999-2069)		
	Government-Managed Nuclear Material	Civilian	Total
Monitored Geologic Repository	9,510	23,090	32,600
Waste Acceptance, Storage and Transportation (including Nevada Transportation)	1,490	4,890	6,380
Program Integration and Institutional	1,580	3,920	5,500
Total[b]	**12,580**	**31,900**	**44,480**
Aggregate Allocation Percent[c]	28.3 percent	71.7 percent	100 percent

NOTES: [a] These future cost allocations differ from the 1999 TSLCC (CRWMS M&O 1999b) since estimated 1999 costs are included for forward-looking analysis.
[b] Totals may not add due to independent rounding.
[c] Percentages are based on allocating total system life cycle costs.

Table 2. Case 2 Summary of Allocations of TSLCC Future Costs (Millions of 1999$)

Category	Future Cost Allocation – Case 2[a] (1999-2144)		
	Government-Managed Nuclear Material	Civilian	Total
Monitored Geologic Repository	10,970	26,090	37,060
Waste Acceptance, Storage and Transportation (including Nevada Transportation)	1,500	4,890	6,390
Program Integration and Institutional	1,840	4,500	6,340
Total[b]	**14,310**	**35,480**	**49,790**
Aggregate Allocation Percent[c]	28.7 percent	71.3 percent	100 percent

NOTES: [a] These future cost allocations differ from the 1999 TSLCC (CRWMS M&O 1999b) since estimated 1999 costs are included for forward-looking analysis.
[b] Totals may not add due to independent rounding.
[c] Percentages are based on allocating total system life cycle costs.

3.1.1 Design Alternative

The LADS Report (CRWMS M&O 1999c) evaluated five design alternatives. The EDA II was selected and forms the basis for the 1999 TSLCC (CRWMS M&O 1999b) estimates. EDA I was the highest cost alternative and, as such, provides a reasonable upper bound for potential cost

increases. Changing to the EDA I design would increase costs since the emplacement area would need to be expanded into uncharacterized areas, and the quantity of waste packages would increase. The LADS Report estimates a 23 percent repository cost increase from changing to the EDA I design from the EDA II design for a 70,000 MTHM system (CRWMS M&O 1999c). Based on total system costs which include extrapolating the EDA I design to accommodate all the waste, and factoring in the remainder of the program costs such as transportation, which would be unchanged, leads to a program cost increase of approximately 20 percent.

3.1.2 Reduction in Cost Uncertainty

Cost uncertainties will be reduced as the program progresses from licensing to construction and finally to waste emplacement. Scope uncertainties will be eliminated as design issues are closed during licensing and major decisions are finalized. Summarized below are major decisions that will affect program scope, which drives system costs, and a schedule for their anticipated resolution:

- Site Recommendation – determines suitability of Yucca Mountain..... 2001
- License Application – narrows design alternatives..... 2002
- Nevada rail transportation route selection – narrows route choices from five to one.....2002-2004
- Construction Authorization – defines additional requirements from NRC review..... 2005
- Determination of need for a second repository.....2007-2010
- Decision to close the repository.....2060-2135
- Repository closed for Case 1..... 2069
- Repository closed for Case 2..... 2144

3.2 REVENUE ASSUMPTIONS

The 1.0 mill per kWh fee revenue used in this analysis was derived from data on the Nuclear Fuel Data Form RW-859 (CRWMS M&O 1996). This data was collected from the utilities for historical discharges and a forecast of future discharges, calculated by extending utility projections to end of reactor life (CRWMS M&O 1998). It is assumed in this projection that commercial units will operate for 40 years from the issuance of their operating licenses without extensions, and reactor performance will not be affected by aging. RW-859 SNF projections and the resulting fee projections have been adjusted for cancellation of three planned nuclear power units (Bellefonte 1 and 2, and Watts Bar 2), and early shutdowns of Zion 1 and 2, Big Rock Point, Maine Yankee, and Haddam Neck. The cumulative discharge of civilian SNF is estimated to be approximately 86,000 metric tons of heavy metal. The actual and predicted burnup of this

discharged fuel was used to obtain an estimate of electrical output, which was multiplied by the fee to obtain the fee revenue, after taking into account plant efficiencies.

This evaluation incorporates the revenue losses resulting from an amendment to the Standard Contract for Disposal. The amendment was required by two District of Columbia Circuit Court decisions: one in 1985 and one in 1989 (Wisconsin Electric Power Co. v. U.S. Department of Energy, 778 F. 2d 1; Consolidated Edison v. U.S. Department of Energy, 870 F. 2d 694). These decisions determined that ongoing nuclear utility fees should be based on electricity generated and sold. In FY 1995, the Department made its final reimbursement to the utilities as a result of this revision to fees collected through FY 1990. For this analysis, the Department assumed a 6 percent reduction in future net generation to account for transmission and distribution losses.

It is assumed that funds paid by the Department for the disposal of DOE SNF and HLW will be sufficient to cover its full cost share and accrued interest. Any outstanding balances for prior year shares will be paid prior to initial waste acceptance. Annual budget request levels for the disposal of DOE SNF and HLW will be developed according to the Department's memoranda of agreement (DOE 1998c, DOE 1998d) and subject to Congressional appropriations. After initial waste acceptance, it is assumed that the Defense Nuclear Waste Disposal appropriations match the annual share for government-managed material.

Table 3 presents the amount of assumed annual appropriations for government-managed nuclear materials through 2015. For this analysis, it is assumed, based on the OCRWM budget planning, that an annual appropriation of $200 Million YOE dollars for Defense Nuclear Waste Disposal is constant from 2002 through 2004. From 2005 through 2009, it is assumed that the annual appropriation is increased to $630 Million YOE dollars for Case 1, and $650 Million for Case 2. A final appropriation of $620 Million for Case 1 and Case 2 would be required in 2010. This level of appropriation would reduce the prior outstanding financial obligation for government-managed nuclear materials to $0 by the start of waste acceptance. Assumed annual defense amounts are included in this analysis since defense appropriations offset expenditures from the Fund.

This analysis calculated the outstanding balance, owed for government-managed nuclear materials, to be $1.5 Billion at the end of FY 1998. The 1999 TSLCC (CRWMS M&O 1999b) recalculated the civilian and government shares based on the updated estimate of total program costs, from inception through closure and decommissioning. Changes to prior year cost shares resulted in an increase in the outstanding obligation for government-managed materials. This analysis assumes repayment of the obligation, as described above, to allow analysis of the adequacy of the fees paid for commercial SNF to fund the civilian share of program costs. The calculation of the outstanding obligation for government-managed materials takes into account both the annual share of prior year costs, and the interest accrued on outstanding obligations. The annual share factor is determined using constant dollars and by applying the methodology published in the Federal Register and described in the 1999 TSLCC (CRWMS M&O 1999b).

Table 3. Assumed Annual Appropriation for Government-Managed Nuclear Materials (Millions of YOE Dollars)

Fiscal Year	Assumed Annual Appropriations for Government-Managed Nuclear Materials	
	Case 1	Case 2
1999	189	189
2000	112	112
2001	112	112
2002	200	200
2003	200	200
2004	200	200
2005	630	650
2006	630	650
2007	630	650
2008	630	650
2009	630	650
2010	620	620
2011	240	250
2012	290	290
2013	340	350
2014	350	350
2015	410	410

Note: Actual payment schedules will be developed in accordance with the Department's memoranda of agreement and subject to Congressional appropriations.

If the disposal fee remains unchanged at 1.0 mill per kWh of electricity generated and sold, the cumulative fee revenues will be equivalent to $24.6 Billion in 1999 dollars. The cumulative fees are comprised of annual disposal fees, one-time fees, and interest accrued on deferred one-time fees. Fee projections for 1999 through 2009 are based on discharge data provided by the Energy Information Administration in an interoffice correspondence from the Director, Coal, Nuclear and Renewable Division to the Director, Waste Acceptance and Transportation Division, September 16, 1999 (Geidl, J. 1999). Annual disposal fee payments total $19.3 Billion (in 1999 dollars) from FY 1983 to FY 2036 ($10.2 Billion for FY 1999 through FY 2036) under the no-new-orders scenario.

The standard contracts for disposal between the Department and utilities provided two deferred payment options for one-time fees. Deferred fees can be paid either as 40 quarterly payments in the 10 years prior to acceptance of fuel, or as a lump sum payment prior to waste acceptance. At the end of FY 1998, $0.9 Billion of principal currently remained deferred and will continue to accrue interest at the 13-week Treasury bill rate. For this analysis, it was assumed that lump-sum payments of deferred one-time fees are to begin in 2010, and coincide with the first pick-up of SNF from a utility with an outstanding balance.

In addition to the fees and interest on deferred one-time payments discussed above, the interest on unexpended NWF balances provides revenue. NWF balances are invested by the Secretary of the Treasury in obligations of the United States with maturities appropriate to the needs of the program. The analysis below addresses the sensitivity of the fee adequacy assessment to future combinations of nominal interest rates and inflation.

3.3 ECONOMIC ASSUMPTIONS

Economic assumptions used in this fee adequacy report consist of inflation and interest rate forecasts, and an assumed investment strategy.

3.3.1 Projected Inflation and Interest Rates

The interest and inflation rates used in this analysis are extracted from the *Cost Escalation and Interest Rates for 1999* (CRWMS M&O 1999a), and are shown in Figure 4.

- Consumer Price Index - All Urban Consumers – This forecast provides the discount rate used to convert YOE fees and income to current year dollars.

- 10-Year and 1-Year Treasury Note Series – The 10-year rate forecast provides the annual nominal interest rate earned on future investment portfolio holdings, excluding current investments. The 1-year note rate forecast provides the annual nominal interest rate earned on the contingency portion of the fund. For purposes of simulating the investment strategy, current investments, held as of September 30, 1998, are assumed to be held until maturity and earn their actual coupon return until maturity.

- 13-Week Treasury Series – This forecast provides the rate used in the calculation of the interest portion of the deferred one-time fees and outstanding balance on government-managed nuclear materials.

3.3.2 Investment Strategy

This analysis simulates the expected results of the program's investment strategy. The objectives of the strategy are to: (1) ensure that investment income is available when needed; (2) support the adequacy of the fee paid into the NWF by waste owners and generators; and (3) hedge against uncertainty and unplanned funding requirements. To achieve these objectives, the NWF is managed as two portfolios: a contingency portfolio and a match portfolio. The purpose of the contingency portfolio is to hedge against reasonable contingencies such as unexpected near-term expenditures. The purpose of the match portfolio is to provide reliable funding for expected program expenditures. It serves to bring into balance the program's assets and liabilities and to maintain that balance. The contingency portfolio is highly liquid and consists of Treasury securities whose average maturity is approximately 3 years. The match portfolio consists of a mix of Treasury bills, notes, bonds, and zero-coupon bonds. The durations and present values are matched or will be matched, year-for-year, to the durations and present values of the program's projected liabilities. Matching investments to planned spending reduces the sensitivity of the fee adequacy balance to changing interest rates. Each month, near-term cash flow expectations and current asset and liability values are re-assessed and used as the basis for

investment selection. The portfolio is rebalanced, as required, upon completion of each new total system life cycle cost analysis or when changes in program assumptions warrant.

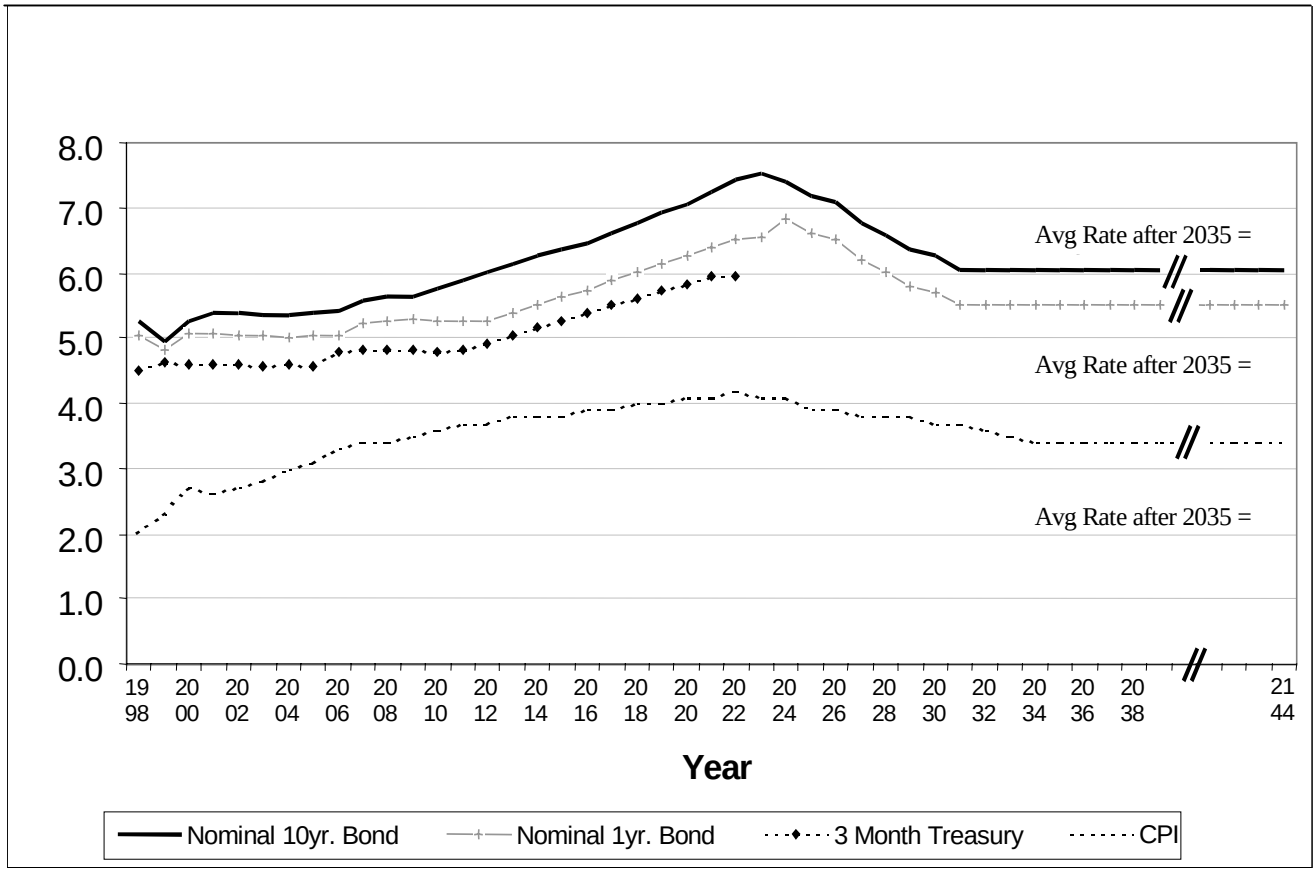

Figure 4. Inflation and Interest Rates Used for Calculating Fee Adequacy

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